Legacy Site Services LLC

Via e-mail and hand delivery

June 22, 2016

Kristine Koch
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900, M/S ECL-115
Seattle, WA 98101-3140

Subject: **Legacy Site Services Request for Formal Dispute Determination regarding the EPA June 8, 2016, Portland Harbor Feasibility Study (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)**

Dear Kristine:

Pursuant to Section XVIII of the 2001 Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study (Consent Order), Lower Willamette Group (LWG) member Legacy Site Services LLC ("LSS"), agent for Arkema Inc. ("Arkema"), initiates dispute resolution regarding the U.S. Environmental Protection Agency (EPA) June 8, 2016, draft final feasibility study (FS) report. EPA previously issued its August 2015 Draft FS report sections after notifying LWG that rather than continuing to work with LWG to revise LWG's 2012 draft FS, EPA would take over the work and issue its own FS. This 2016 FS contains substantial changes from EPA's 2015 Draft FS report sections, many of which are the subject of this dispute. Consistent with the LWG's February 4, 2016, agreement with EPA, we understand that the dispute process will be streamlined by proceeding directly to the formal determination phase, and the Environmental Cleanup Office Director's decision is anticipated to be made simultaneously with the agency's remedy decision after considering all public comments along with the disputed issues.

Based upon the very brief time LSS has had to review EPA's FS, it is apparent that EPA has evaluated the protectiveness of the FS alternatives by methods that are inconsistent with the approved baseline risk assessments and has failed to incorporate appropriate risk management principles into its development, screening, or evaluation of alternatives. Although the FS differs substantially from EPA's August 2015 Draft, it lacks a complete and transparent evaluation of the long- and short-term effectiveness of the alternatives, as well as of the degree to which implementation of those alternatives will reduce the toxicity, mobility, or volume of hazardous substances including through treatment of material it has labeled principal threat waste (PTW).

Many of the comments on the draft FS report sections provided to EPA on behalf of LWG were not considered or incorporated into EPA's 2016 FS report. The cost projections in the FS are also not supported and are grossly inaccurate. The FS also fails to articulate a clear, accurate, and understandable framework and schedule for implementation by which each alternative can be compared. In addition, EPA's FS is based on an outdated data set that does not include recent data

Legacy Site Services LLC
486 Thomas Jones Way, Suite 110
Exton, PA 19341-2528
Tel: 610 594-4421

collected at the Portland Harbor site (e.g., 2011 fish tissue data, 2014 surface sediment PCB data, and recent River Mile 11E early action data) or coincide with the impact of recent upland source control measures (SCMs). The FS recognizes some areas of data deficiency, but fails to specifically identify and describe those data gaps and limitations or provide a clear mechanism for incorporating pre-design and design data to refine or modify remedies prior to implementation. For these reasons, the FS fails to provide an adequate foundation for EPA to reasonably conclude that certain FS alternatives are not protective or fail to comply with applicable or relevant and appropriate requirements (ARARs), or that any one of the alternatives is on balance, more effective, implementable, or cost effective than any other alternative.

The following sections provide details on some of LSS' key dispute issues on EPA's Draft Final Feasibility Study dated June 8, 2016.

1. Inadequate Conceptual Site Model

EPA's inadequate conceptual site model (CSM) does not provide an adequate foundation for a thoughtful comparative evaluation of alternatives. The FS does not sufficiently describe the relevant site features, baseline risks, sources, chemical fate and transport, site uses, and other important factors necessary to understand the potential cost effectiveness of EPA's remedial alternatives. Information on contaminant fate and transport is not provided in EPA's CSM discussion. In addition, the site has been characterized by EPA based on aggregated sediment data (i.e., sediment data collected over more than a decade) without regard to time-dependent changes operating in this system. It is not possible to effectively evaluate remedial alternatives without a robust CSM of the site.

Some examples of specific technical issues with the CSM presented in EPA's FS report include the following:

- Aggregating sediment data from the late 1990s through 2007 for the purpose of performing a sediment surface characterization. This is a fatal flaw in EPA's analysis as it prevents any signal of dynamic conditions from being observed; this is also an essential component of monitored natural recovery (MNR)that EPA has included as an important element of every alternative.

- Assuming without evidence, and ignoring subsequent evidence to the contrary (including 2012 fish tissue, 2013 sediment profile imaging [SPI] data and 2014 sediment data) that the sediment surface conditions at this site are at steady state. The Portland Harbor site is clearly a dynamic system. This is a fatal flaw in the CSM.

- Ignoring subsurface conditions where geochemistry and microbiology are key parameters associated with the natural recovery of several constituents for which EPA deems remediation a requirement. We know many areas of this site are under reducing conditions based on the presence of methane in cores. Reductive dehalogenation is a known pathway for natural recovery for some chlorinated compounds. *In situ* processes of natural recovery should have been addressed in the CSM and the FS. This is particularly important as a consideration for active remediation areas determined by EPA to be located landward of the pier-head line at the Portland Harbor site.

- It is unclear if the sitewide total PCB spatially weighted average concentration (SWAC) values presened in EPA's FS included the RM 11.2 information acquired during the Supplemental RI performed in Segment 1 (River miles 9 to 11.7). This creates a significant problem in the comparison of subsequent surface SWACs because it suggests site conditions at the time of the RI were actually cleaner than they were. This makes the demonstration of significant sitewide natural recovery more difficult and inaccurate.
- The use of highly uncertain SWAC values (in some cases the SWAC values varied by an order of magnitude) in localized segments of the site to establish predicted tissue concentrations. This indicates a significant scale effect associated with the surface data used to support the CSM that indicate a lack of characterization in "extent" in the near field of EPA's CSM.
- A flawed approach was used for calculating site background concentrations (see dispute issue 11 below).

A robust surface sediment data set that is representative of current conditions is critical for setting up initial conditions for the alternatives evaluated in the FS. EPA's FS uses aggregated sediment data from 1997 through 2007 for the surface sediment characterization. When these outdated data are used to define surface sediment concentrations at the site, it shifts the "knee of the curve" for comparing alternatives away from the alternatives with less active remediation (B, C, and D) and toward alternatives with more active remediation (E, F, G, and I). Graphs of PCB sitewide SWAC versus duration for EPA's FS SWAC (84 µg/kg) and the SWAC based on the recent 2014 sediment data (40 µg/kg) are presented in Exhibit 1. CSM errors and omissions need to be corrected to properly understand the source, distribution, fate, and transport of site COCs and to accurately assess and weigh the differences between remedial alternatives.

2. Principal Threat Waste Adjacent to the Arkema Site

EPA inappropriately identifies chemicals in sediment adjacent to the Arkema Site as PTW based on either a "source material," "not reliable contained," or "highly toxic criterion. As expanded upon below, source material has never been identified in Arkema Site sediment; EPA should not identify chemicals that can be reliably contained as PTW; and chemicals that require long-term exposure durations through indirect exposoure pathways (i.e., consumption of fish tissue) should not be identified as "highly toxic." In addition, the blanket identification of large areas with low concentrations of chemicals in sediments as PTW is neither required by the National Contingency Plan (NCP) nor necessary to protect public health or the environment.

EPA errs when it misidentifies source material in the FS based on "globules or blebs of product in surface and subsurface sediments…." and when it states "NAPL observed in sediment cores offshore of Arkema contains chlorobenzene and DDT (dissolved)." Arkema/LSS disputes the presence of NAPL globules and blebs related to the site or historical site operations (i.e., sheens related to oils and other uses of the river by ships and other vessels are not related to Arkema and would not contain Arkema contaminants such as MCB). Arkema/LSS responded to CDM Smith's 2013 memorandum (Exhibit 2) that purports to identify NAPL at the Arkema site. To resolve the issue, Arkema prepared a work plan in response to EPA requests under the EE/CA Administrative Order on Consent (AOC) to yet again confirm that NAPL was not present in sediment adjacent to the Arkema site (Integral 2016, Exhibit 3). In addition, no samples of NAPL offshore of Arkema have identified an MCB NAPL. There is no data that supports EPA's statement that NAPL observed in Arkema sediment "…contains chlorobenzene….". Significantly, a document titled "Top 10 State Issues for Proposed Plan" obtained from the LWG's Freedom of Information Act (FOIA) request identified that based on Oregon DEQ's review of the data "The multiple phases of sediment investigation have not encountered sediment exhibiting NAPL saturated conditions that would warrant thermal treatment prior to management." The status column for the same issue states that "EPA agreed to not assume NAPL at Arkema for the purposes of the cost estimate" (Exhibit 4). Based on these records, we conclude that EPA and DEQ agreed that there was no MCB NAPL in offshore sediments, and therefore the assertion that such sediments represent PTW Source Material as defined by EPA's PTW fact sheet is without foundation, acceptance, or support.

EPA erred when it identified an extensive area of groundwater containing MCB DNAPL discharging to the river as "not reliable contained" (Exhibit 5). First, there is no documented MCB DNAPL groundwater plume to the extent shown in EPA's Figure 3.2-4, adjacent to the Arkema site. The nature and extent of MCB DNAPL in groundwater or sediment porewater as shown in this figure <u>is not based on any current site data</u>. Second, groundwater SCMs have been implemented at the site beginning in 2012, including an upland groundwater barrier wall and extraction and treatment system. The groundwater pathway to the river from upland areas that have MCB in groundwater has been cut off and continment has been in existence for 4 years, and therefore, there is no ongoing source of dissolved phase MCB to the sediment adjacent to the Arkema site. There is no scientific evidence that supports the existence of an ongoing source of MCB DNAPL to the sediment adjacent to the Arkema Site. Groundwater and porewater sampling conducted after the implementation of the SCM has not identified a MCB DNAPL source to sediment adjacent to the Arkema Site. The site characterization error which postulates an extensive area of chlorobenzene DNAPL in sediment at the Arkema Site biases the assessment and comparison of the effectiveness of alternatives as evidenced from the following text: "Alternative D has less capped area (71 acres), but does not reliably contain all PTW remaining in the river." (USEPA 2016, p. ES-15). Without an accurate assessment of NAPL, PTW and PTW areas, EPA's alternatives evaluation is highly inaccurate.

EPA errs when it misidentifies the remaining areas of the Arkema site (including areas upstream and downstream of Arkema; Exhibit 5) as containing "highly toxic" PTW based on surface sediment concentrations for DDx, 2,3,7,8-TCDD, 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 2,3,4,7,8-PeCDF, and 1,2,3,4,6,7,8-HxCDF that exceed a 10^{-3} excess cancer risk level for fish consumption based on the fish ingestion risks from the baseline human health risk assessment (BHHRA). This definition of highly toxic based on a long-term (30 year) exposure to a chemical substance via a fish consumption pathway is not the intent of EPA's PTW fact sheet. These 10^{-3} risk levels include long-term exposure parameters and indirect exposure based on a 30-year subsistence fish consumption scenario, which does not meet the definition of highly toxic (i.e., toxic under a direct contact or acute exposure scenario). Highly toxic levels should be based on direct exposure conditions only. Furthermore, the 10^{-3} excess cancer risk is only a suggested basis and is not prescriptive.

The EPA's proposed highly toxic PTW levels should also be considered in a broader context. EPA's highly toxic PTW values for some constituents are well below cleanup levels and screening level for unrestricted use established for other sites and scenarios. For example, the PCB PTW value of 200 µg/kg is below cleanup goals for many other CERCLA sites, which are at or above 200 µg/kg, typically in the 1,000 µg/kg range. The EPA regional screening level (RSL) for residential soil in fact is 249 µg/kg; in other words, soil with PTW levels specified in the FS could be used as clean fill at homes, schools, and day care facilities. In this context it does not make sound technical or risk management sense for the PTW level to be set at 200 µg/kg. An approach more consistent with the intent of EPA's PTW guidance would be to set the PTW level at a 10^{-3} risk value based on direct contact to sediment (removal action objective 1 [RAO1]); that would be the lower of the 10^{-3} risk level (370,000 µg/kg), the hazard quotient (HQ) of 10 (147,600 µg/kg) (as stated in the guidance), or for the PCB case, the TSCA waste threshold (50,000 µg/kg). The use of the TSCA threshold for PCBs is also consistent with decisions at other CERCLA sites. A similar approach should be taken for the other constituents for which highly toxic PTW has been identified, especially dioxins/furans for which the PTW level in the FS is less than 3 times the EPA-recommended preliminary remediation goals PRG for dioxins/furans (once toxicity equivalence factors (TEFs) are applied). LSS belives that application of the revised and readily accepted PTW standards for not reliable contained or highly toxic material will result in none of the sediment at the Arkema site being identified as PTW.

3. Inappropriate waste designation for sediments adjacent to the Arkema site

The assumed areas for disposal of sediment as RCRA waste (Figure 3.4-35, Exhibit 6) are based on a single toxicity characteristic leaching procedure (TCLP) sample for lead[1] and no TCLP samples for chromium. Based on sediment analytical results, the area shown on Figure 3.4-35 does not represent sediment that will require RCRA Subtitle C landfill disposal. The State-listed pesticide residue designation also does not necessarily apply to sediment at the Arkema Site (Figure 3.4-36, Exhibit 6). As recently as February 2016 DEQ was researching the issue of whether sediment near Arkema would be designated a State-listed pesticide waste. Item 3 of the "Top 10 State Issues for Proposed Plan" document obtained from the LWG's FOIA request (Exhibit 4) states that "Sean needs State determination of State-only pesticide question, which Matt is researching." However, even if it is determined that some portion of the sediment is a State-listed pesticide residue waste, it would not preclude the placement of this sediment in a CDF (see HWIR discussion below) or disposal in a Subtitle D landfill out of state. When a State-listed hazardous waste is transported out of state (i.e., the Roosevelt Regional landfill presented in the FS), the Oregon State waste designation no longer applies, and the waste can be disposed as a non-hazardous waste so long as it meets other landfill disposal criteria. This waste disposal process was recently demonstrated by the disposal of soil from the Arkema Stormwater and Groundwater SCMs, which was disposed of at Roosevelt landfill in Washington.

Arkema disagrees with the cost assumption that "cement solidification/stabilization, low temperature thermal desorption, and no treatment will be used in equal proportions to treat

[1] The analytical results minimally exceeded TCLP regulatory limits for lead in this sample. LSS notes that the TCLP samples were collected from specific intervals from single boreholes and were not necessarily representative of the general area around these boreholes. As perhaps a more appropriate approximation representative of bulk sediments, drummed sediments that contained the referenced sample intervals were re-sampled and analyzed for TCLP to evaluate the disposal options for these sediments, and none of those re-sampled drums exceeded the TCLP concentrations.

pesticide/chlorobenzene PTW" for the disposal of dredged sediment that meets EPA's PTW criteria from the Arkema site. Not withstanding the fact that there are no PTW sediments currently identified off the Arkema Site, the FS fails to clearly outline the basis for EPA's assumptions regarding treatment as a prerequisite for offsite disposal. Section 3.2.2.3 makes vague references to regulatory "standards" and "requirements;" however, it fails to clearly identify specific regulations and the conditions under which they are assumed to apply, or not apply, to sediments that are designated as PTW and the mechanism under which they derive need for treatment prior to offsite disposal. Furthermore, the "Top 10 State Issues for Proposed Plan" document obtained from the LWG's FOIA request (Exhibit 4) states that "DEQ wants to be clear that land disposal of these sediments does not require treatment under Oregon Administrative Rules." As presented, EPA has arbitrarily made more conservative assumptions for disposal of PTW defined by sediments containing DDx and NAPL than it has for PCBs, dioxin/furans, and PAHs. LSS believes that based on current data, none of the sediment at the Arkema site should be classified or handled as a Federal- or State-listed hazardous waste.

4. Inappropriate Application of the Hazardous Waste Identification Requirements (HWIR) Rule for Disposal of Sediment in a CDF

EPA's FS asserts that

> Dredged material subject to requirements of a permit that has been issued under Section 404 of the CWA is excluded from the definition of hazardous waste (40 CFR 261.4(g)). This provision is discussed in the Hazardous Waste Identification Rule (HWIR) (63 Federal Register [FR] 65874, 65921; November 30, 1998). Oregon State adopted the HWIR rule in 2003. <u>This rule means that RCRA regulatory requirements do not apply to sediment dredged at the Site and disposed of on-site, such as at the Terminal 4 CDF, if the material otherwise meets the CDF acceptance criteria.</u> (emphasis added)

EPA has correctly stated that RCRA regulatory requirements, including the designation of waste sediment as either a Federal or State-only hazardous waste, do not apply to sediment placed in a CDF; however, the statement mischaracterizes the CWA requirement that the sediment must meet CDF acceptance criteria for this rule to apply. This is simply not the case. Because DEQ has adopted the federal HWIR-media rule, and the CDF would meet CWA Section 404 requirements, RCRA Subtitle C requirements would not apply, and the dredged material placed in the CDF would not be a hazardous waste. The disposal of Arkema sediment in a Terminal 4 CDF should, therefore, be considered. The failure to consider CDF disposal for Arkema dredged sediment artificially inflates the disposal costs for alternatives related to the dredging at the Arkema site. In conclusion, EPA disregards the scope and intent of the HWIR Rule by placing arbitrary restrictions on what EPA believes can be placed into the T4 CDF if constructed. All of the EPA's Acceptance Criteria for the T4 are arbitrary and should be removed. Disposal of dredged material should follow the HWIR Rule as adopted by the State. This arbitrary action by EPA have severe negative implications for the FS and any subsequent RA.

5. Feasibility study sediment and fish tissue dataset is not representative of current site conditions

EPA's draft final FS is based on a data collected between 1997 and 2007 and is not representative of current conditions at the site. The 2014 surface sediment PCB data collected by Kleinfelder to provide a current reference for comparison of the Portland Harbor RI dataset was not discussed or evaluated in the FS. It is unclear if the recent sediment PCB data collected by the RM11E Group was included in EPA's FS. These data are critical to the FS because the RM11E area is a source of PCBs in the upstream portion of the site and has significant implications for assessing remedial alternatives, calculating SWACs, and assessing residual risk for the Portland Harbor site. PCBs are the primary risk driver for the Portland Harbor site and some of the most critical data for evaluating PCBs was omitted by EPA in the FS report.

A surface sediment and fish tissue dataset representing current conditions must be generated for the FS to accurately assess remedial alternatives. A new dataset will account for natural recovery that has occurred at the site since the Portland Harbor dataset was collected between 9 and 19 years ago and will fill a critical data gap in EPA's FS.

In Section 3.6.1.3, EPA's updated evaluation of fish tissue concentrations over time ignores 2002 data without any explanation. EPA states in this section a downward "trend" in fish tissue concentrations.

> In all but two instances (RMs 4E and 7E), concentration declines were not statistically distinguishable from zero. Possible explanations are the trend itself is close to zero, or the estimated coefficient could be very different from zero with a very wide confidence interval. The former would imply that the decay rate is small and that it is simply close to zero with strong level of confidence, whereas the latter indicates that the data are too sparse to precisely estimate the decay rate.

This section also states that the previous fish data are sufficient for baseline conditions for PCBs. This statement is incorrect since these data will be nearly 10 years old when the remedy is implemented and will not be representative of baseline conditions.

The Arkema pre-remedial design investigation work plan (Integral 2016) evaluated natural recovery at the Portland Harbor site (Exhibit 3, Appendix H). In this analysis, the original RI data sets were evaluated against more recently collected smallmouth bass fish tissue (2012), SPI (2013), and surface sediment PCB (2014) data. Based on a total of eight lines of evidence, including tests of statistical significance and a likelihood analysis, the weight of evidence strongly supports that natural recovery is occurring and will continue to occur within Portland Harbor. Therefore, MNR is a strongly viable process that should be utilized in Portland Harbor sediment remedies, including the area adjacent to the Arkema site. This analysis and its conclusions are directly relevant to EPA's alternatives analysis, comparison, and effectiveness evaluation, and therefore the lack of more recent data analysis biases the conclusions of EPA's alternative analysis and selection for sediment management areas (SMAs), including SMA 7W. EPA should incorporate the complete existing fish tissue data sets, as was done in the Integral (2016) analysis, and also allow for an updated fish tissue collection study to determine the current baseline fish tissue concentrations of COCs and demine the current site risk.

6. Inappropriate use of PCB non-detected values in RAL and PTW footprint maps

The RAL and PTW footprint maps incorporate data with high PCB detection limits adjacent to the Arkema site (Exhibit 7). The high PCB non-detects with detection limits 5 times EPA's PTW value (e.g., >1 mg/kg) occurred in the Aroclor analysis as a result of a matrix interference with

DDx. The RAL and PTW footprint maps should only consider detected PCBs based on PCB congener concentrations adjacent to the Arkema site due to the well-known matrix interference with DDx in PCB Aroclor analyses. The identification of PTW and remediation footprints for PCBs adjacent to the Arkema site based on non-detect values with elevated detection limits resulting from matrix interference with DDx is inconsistent with EPA's PTW fact sheet guidance and biases the assessment of PTW and remediation footprints for the SDU RM7W alternatives. This exaggerated PCB footprint will also bias the alternative selection for SDU RM7W. EPA should remove the PCB non-detect value from this PCB footprint analysis as it biases and exaggerates the area of PCBs in sediment at the site. If necessary, additional PCB congener data could be collected from these high non-detect sample locations to confirm the absence of high concentrations of PCBs at these locations.

7. Inaccurate RAL and PTW footprint maps

The PCB and PCDD/F RAL and PTW maps were contoured using natural neighbors gridding and did not account for the flow direction or depositional environments in a river system. The RAL and PTW maps in EPA's FS report blindly used nearest neighbor interpolation, and data points were inappropriately interpolated through upland areas. An example of this inappropriate interpolation is between points in the Willbridge Terminal and the area between Dock 1 and the Salt Dock on the Arkema Site (Figures 3.4-7, Exhibit 7 and 3.4-11, Exhibit 8). In this example, the points are not correlated and should not be interpolated through the upland portion of the Arkema site. The RAL and PTW maps must include some interpretation to reflect the physical features of the site and site uplands, as well as the hydrodynamics of a river system. This manual interpretation should be done for the PCB and PCDD/F maps covering the area adjacent to the Arkema site.

8. Inconsistent risk assessment methods and risk inequality for various compounds

Interim targets for risks and hazard indices (HIs), which were established by EPA in the FS "…to evaluate the potential for achievement of PRGs in a reasonable time frame" (Section 4.1.3) were not consistent between chemicals of concern (COCs) and RAOs. As such, estimated residual risks were not consistent among the COCs (e.g., total PCBs has 5x10-5 residual risk and DDx has 1x10-6 residual risk for RAO2 [Appendix J, Table J1-2]). This is mainly due to a very low and unattainable sediment PRG that was calculated using average fish tissue concentrations and ambient water quality criteria (AWQC) for surface water inputs to the food web model (FWM), which resulted in very low or even "0" value PRGs (issues related to the FWM are provided below in dispute issue 13). This then resulted in defaulting to background for several COCs. Remediation to background levels is not realistically achievable.

This FS also adopts entirely new methods to estimate pre- and post-construction risks for the alternatives (Appendix J). The residual risk evaluation process is neither technically sound nor transparent. There is no rationale or a clear example provided for the process. The FS states that methods used to evaluate residual risks are consistent with the Baseline Risk Assessments, but this is not an accurate characterization of these methods. Some examples of differences in risk assessment methods and assumptions include:

- Fish meals/10 years was not used in the BHHRA and no rationale was provided in the FS for using this unit.

- Appendix J presents the RM/SDU residual risks using fish ingestion rate of 49 g/day, however, PRGs based that ingestion rate have not been selected in the FS.

The difference in the risk assessment methods risks is apparent if the risks estimated for Alternative A (no action) are compared to baseline risks from the BHHRA—these should be the same.

- The only spatial scale that allows for direct comparison of risks is at the sitewide scale. The sitewide fish consumption risks estimated in the BHHRA (summarized in Section 1.2.5.1) are higher than those presented for Alternative A in Table J2.3-1a. However, the risks for Alternative A are based on average concentrations whereas the BHHRA risks are based on 95% upper confidence limit (UCL) or maximum concentrations. The average PCB concentration in the BHHRA based on actual tissue data was 160 µg/kg in bass and 2,500 µg/kg in carp, which includes a single outlier sample of 19,000 µg/kg (the average without the outlier is 353 µg/kg). The modeled tissue concentrations used for Alternative A are 352 µg/kg for bass and 820 µg/kg for carp, which are approximately 2 times higher than the measured tissue concentrations (excluding the single carp outlier).

- The river mile risks for Alternative A cannot be compared directly with the BHHRA because the risks for Alternative A are on a rolling river mile basis for both sides of the river and navigation channel whereas the BHHRA risks were for an entire river mile. The risks for Alternative A are generally higher than those in the BHHRA (potentially due to spatial scale issues). In the BHHRA, risks at RM 11 were $1x10^{-3}$ and all other risks were less than $1x10^{-3}$. For Alternative A, there are several segments with risks of $1x10^{-3}$ or higher.

- There continues to be an issue with EPA's modeled dioxin/furan tissue concentrations. In the BHHRA, the sitewide risk from the total toxicity equivalent (TEQ) based on the 95% UCL or maximum concentration for actual tissue data was $2x10^{-4}$. For Alternative A, the sitewide risk from 1,2,3,4,7,8-HxCDF alone based on an average concentration is $6x10^{-4}$ (Table J2.3-1a of EPA's FS report). There is no way that the risk from an individual congener can be higher than the total TEQ.

- Furthermore, the residual risk assessment appears to present relative risks and not absolute risks. The term "residual risk" is used in different ways throughout the document, but it appears that EPA first estimated risks associated with the selected PRG (in general a risk of $1x10^{-6}$ or an HQ of 1 where the PRG is risk-based, but some other value if the PRG is not risk-based). For example, for RAO2, the residual risk (which is a ratio of the selected tissue PRG to the risk-based tissue PRG) for DDx is 10^{-6} because the fish tissue PRG (3 parts per billion [ppb]) is equal to the risk-based tissue PRG (3 ppb). However, for PCBs, the risk-based fish tissue PRG is 0.5 ppb and yields a "0" sediment concentration, and the PCB sediment PRG, which is the background value of 9 ppb, is apparently used in the FWM to calculate a PCB fish tissue concentration of 23 ppb (Table J1-2 of the FS). The sitewide residual risk for PCBs was estimated to be $5x10^{-5}$ (i.e., 23 divided by 0.5 and multiplied by 10^{-6}). Then the "post-construction risks" was calculated for each alternative using SWACs to estimate fish tissue concentrations, again using the FWM and ratio of this "post-construction risk" and the "residual risk" to understand the "magnitude of residual risk." Again, this is relative risk and not absolute risk. Therefore, the risks between COCs are not comparable as some are based on actual risks (where the selected PRG is risk-

> based) and some are relative risks (where the selected PRG is not risk-based). This approach is not at all consistent with the methods of the BHHRA and BERA and also misleading.

The post-construction sediment concentrations also appear unrealistic. For example, some of the PCB and DDx post-construction concentrations in Table J2.3 are below the background concentrations. Other tables in Appendix J show similar results. It is unclear how remedies will result in concentrations below background. In addition, the concentrations of COCs used in the remediated areas to calculate the post-remediation SWACs were 0, which does not account for dredge residuals or background (upstream) concentrations of COCs.

A significant deficiency of the residual risk evaluation is that it does not provide residual risks for any time frame other than the immediate post-construction condition (Time 0). As reported in the FS (Section 4.1.3):

> As a long-term model is not available to predict the time to meet the PRGs, interim targets for risks and HIs were established to evaluate the potential for achievement of PRGs in a reasonable time frame, which was considered to be 30 years, commensurate with the site-specific contaminants and conditions. These interim targets are higher than residual risks once PRGs are achieved, and assume that further reductions with be achieved through MNR.

The calculated post-construction risks and HI values are higher than the interim target risks and HI. Because much of the remedy relies on MNR, the lack of a residual risk estimation process for time intervals post-construction (up to year 30) makes the usefulness of the residual risk estimates limited and almost worthless in terms of comparing the protectiveness of the remedies.

Furthermore, there is very little difference in net risk reduction between Alternatives B and I for almost all COCs. For most of the COCs, the differences are less than a factor of 2 and sometimes much smaller (e.g., difference in HQ of 0.25). Given the very conservative assumptions that were used to calculate PRGs, differences in estimated risks by a factor of 2 or less are not significant. A more reasonable criteria for evaluating differences in estimated risk between alternatives would be a factor of 10, which should be considered the minimum significant difference given the limited sensitivity of these criteria. A probabilistic-type risk evaluation, which incorporates the quantitative uncertainties, would be a more appropriate approach.

This small difference in risk reduction between alternative remedy scenarios is likely due to the driving PRGs being based on background. The risk associated with background levels of COCs should be presented in a side-by-side comparison to the residual risk estimates in order to demonstrate the benefit of the remedial measures to the public. Based on the residual risks presented, any remediation beyond Alternative B (which does show a great degree of risk reduction from Alternative A, no action, than the difference between other alternatives) is unwarranted. The very large increase in costs for minimal and insignificant risk reduction between Alternatives B and I is not recognized in the FS.

In summary, the removal volumes in Alternative I cannot be justified as a cost-effective reduction of risk in comparison to other alternatives. Nor can the use of mixed criteria such as PRGs (and RALs) from different alternatives (i.e., “E” and “F” applied either site-wide or within an SMA) be justified based on differences in risk outcomes that are with an order-of-magnitude. To adequately assess the alternatives, an accurate assessment of risk needs to be completed using the risks identified in the EPA-approved BHHRA and BERA. The improper modifications to the risk assessments and assessments of residual risk should be removed from the FS document.

9. RALs are not tied to PRGs and site risk

It is not clear how the RALs equate to risks, other than value for Alternative H, and only if based on the 10^{-6} risk-based PRG but not based on background. The risks from the RALs and background levels of COCs should be presented side-by-side to demonstrate the risk reduction for these alternatives.

Risk-based PRGs should be consistent with the spatial scales of the exposure scenarios used to characterize risk in the approved baseline human health and ecological risk assessments for evaluating cleanup alternatives. The spatial scales over which the PRGs are applied are a key element of the respective exposure scenarios being represented by the PRG. The spatial scales are as fundamental to establishing PRGs as the numeric values themselves. Various spatial scales were used in developing PRGs in the FS (Section 4.1.1): (1) Benthic risk was evaluated on a population level as the area exceeding RAO5 PRGs (2) 0.5 RM was used for RAO1 (sediment only) for direct contact exposure of people engaged in fishing activities, (3) 1 RM was used for RAOs 2 and 6 for the dietary exposure of humans and ecological receptors that consume fish and shellfish, and (4) Sitewide for RAO2. In the FS, COC concentrations were estimated on a rolling average developed from the surface sediment data in the FS database. Surface sediment results were averaged over a distance of 0.5 mile (RAO1) or 1 mile (RAOs 2 and 6) in successive 0.1-mile increments in both the east and west nearshore segments, and the navigation channel. Although the spatial scales match the baseline risk assessment exposure areas, the sediment concentrations calculated for the alternatives are not the same as in the baseline risk assessments and therefore, residual risks for the various alternatives cannot be compared to baseline conditions, except for sitewide conditions (see dispute issue 8 above).

For RAO2, two scales were used to derive two sets of PRGs, sitewide and 1RM, using consumption rates of 142 g/day (based on the subsistence fisher) and 49 g/day (based on the recreational fisher), respectively. However, the selected PRGs for RAO2 are shown to be the ones derived based on the sitewide scale (shaded green in Table B3-5). The 1RM scale PRGs assume that recreational fishers will only be exposed to that portion of the river, which is a very conservative and unrealistic assumption. The RALs for RAO6 only used the 1 RM scale. This corresponds with the home range of species such as smallmouth bass, hooded merganser, osprey, bald eagle, and mink that were evaluated in the BERA. Ecological risk is managed on a population scale and even if a home range is within a river mile, the contiguous population may be exposed over a larger area.

In summary, the spatial scales, exposure scenarios, and estimation of exposure concentrations for the remedy development and residual risk evaluations vary from those used in the BHHRA and no clear rationale is provided for the approach.

In Table 2.2-3, several COCs have “A” under the columns for RAOs 3, 4, or 8. It is unclear why this is necessary. There are no data to justify selection of ARAR-based COCs as provided in Table 2.2-3a. The FS text simply states “contaminants that were detected in upland media (storm water and groundwater) that may potentially migrate to the river at concentrations that would exceed the Safe Drinking Water Act MCLs and national or State of Oregon water quality criteria were also designated as ARAR-based COCs." Data or references are required to substantiate this assertion. In addition, the rationale behind assignment of ARAR-based PRGs is not clear and transparent.

For some COCs (PCBs and dioxin/furan congeners), the sediment PRGs (RAO2) that were developed using the FWM based on target tissue concentrations were assigned a value of zero. Therefore, the PRGs selected for these COCs are background. The mathematical rationale provided is that when using the FWM, dissolved concentrations alone are predicted to result in estimated tissue concentrations greater than the risk-based target. This indicates some flaw in the FWM. Appendix B also states that the FWM presented in detail in the Bioaccumulation Modeling Report (Windward 2015) was submitted to, but **not approved**, by EPA. However the sediment PRGs for RAO2 and RAO6 are based on this FWM. Note, for RAO6, sediment risk-based sediment PRGs could be estimated for PCBs and dioxins/furans (much higher than background). For the FWM, the OR AWQC were used as post-remedial water concentrations. Note that LWG has disagreed with the use of AWQC in the FWM; instead upstream water concentrations should be used.

It is also not clear if risk from background was accounted in the risk reduction. In addition, some of the post-construction calculated sediment concentrations are below background.

The RALs developed for dioxins and furans in the FS (Section 3.4.1.2) are based on several assumptions leading to low confidence and high degree of uncertainty. PRGs for dioxins/furans are less than or within the MDLs. The FS recognizes that due to low data density, interpolations are required across large areas with no data, leading to large footprints that exceed these uncertain RALs.

The RALs need to be related to the PRGs for the site that were developed from the EPA-approved BHHRA and BERA. The spatial scales, exposure scenarios, and estimation of exposure concentrations for the remedial levels, should be on the same basis as for the BHHRA and BERA. Remedial levels should be no lower than background for COCs that have PRGs that based on background. Uncertainty in remedial areas identified needs to be accounted for in the cleanup area assessment especially for COCs that have small data sets and low data density, such as dioxins and furans.

10. PRGs and RALs are inconsistent with other sediment sites

EPA's Portland Harbor PTW value for total PCBs (200 µg/kg) is much lower than the hot spot remediation and expanded hot spot remediation values for the Hudson River site (30,000 and 10,000 µg/kg, respectively). Cleanup goals for other sites are significantly higher than the PTW concentration for Portland Harbor and were not defined as PTW for these other sites. For example, the PCB cleanup goal protective of human health is 386 µg/kg for Yosemite Slough in San Francisco, California; 1,240 µg/kg for Hunters Point, California; and 1,000 µg/kg for Fox River, Wisconsin. The cleanup goal for Passaic River in New Jersey is based on the background of 460 µg/kg. All of these cleanup goals protective of human health are greater than the 200 µg/kg PTW value for PCBs proposed for Portland Harbor.

PRGs developed in the FS using parameters and assumptions used in the baseline risk assessment are considered very conservative. For the BHHRA, upper end of the exposure parameters were used for estimating risks. For example, assuming a subsistence fisher would consume fish 149 g/day from the site alone is highly unlikely. Not refining these conservative assumptions for developing PRGs is considered unrealistic. The FS should utilize assumptions and targets that are reasonably achievable given the background conditions and other factors affecting implementability.

EPA's use of sediment PRGs for riverbanks, even on areas rarely inundated and without considering attenuation, is technical inappropriate. Delineations of groundwater plumes and riverbanks, and a zero post-construction restoration time frame are arbitrary. There is a total lack of data and analysis as to what risk considerations are driving the specific remedial actions delineated (and therefore how this will be refined in the design phase when further data/analysis is available) and what specific remedial actions will be implemented in which areas driven by those risks. This arbitrary delineation is then carried forward into the evaluation of alternatives and given weight for assessing the relative effectiveness of alternatives.

EPA's Portland Harbor PTW value for total PCBs (200 µg/kg) is much lower than hotspot remediation and cleanup goals for other PCB-imapcted sites. EPA should modify the PTW values in the FS to make them consistent with other sediment sites such as the Hudson River site noted above.

11. Methodology for calculating background concentrations

EPA's proposed background values based on inappropriately derived upstream bedded sediment statistics are unlikely to represent achievable cleanup levels for the site. The FS also does not present background concentrations for surface water and does not present sediment background concentrations for all chemicals with sediment PRGs.

A sediment remedy must include evaluating what is deposited within the Study Area, both physically and chemically (i.e., potential future bedded sediment equilibrium). EPA has not conducted such an evaluation. The cleanup goal for PCBs of 9 ppb based on EPA's calculation of background concentrations is not achievable. Background should not be used to establish cleanup goals when likely ongoing contaminant inputs from upland sources within the Site and upriver of the Site exceed EPA's calculation of background. The LWG provided EPA an evaluation of equilibrium concentrations for the Site that are a much more reliable indicator of future concentrations that can be achieved.

More specific detail is provided below for PCDD/F compounds in sediments and other COCs and media.

11a. Background concentrations PCDD/F compounds in sediment

Sediment PRGs for RAO2 and RAO6 as well as riverbank PRGs for RAO9 for the five PCDD/Fs congeners are based on background concentrations. Background PCDD/F concentrations for individual congeners are presented in Appendix B, Table B2-4 of EPA's FS.

EPA uses new methods for deriving these levels that appear significantly different from both EPA's methods for other chemicals as well as past LWG input on this subject. Sediment PRGs for RAO2 and RAO6 as well as riverbank PRGs for RAO9 for the five PCDD/Fs congeners are based on background concentrations.

The background values are based on limited and poor quality data (with elevated detection limits). In fact, only one congener has sufficient data (1,2,3,4,7,8-HxCDF) to calculate a background value and even that is limited (13 of 31 samples were non-detects). Thus, most of the background "values" are based on a 95% UCL of the detection limits. The background values also appear skewed quite low compared to other urban watersheds.

The background values estimated based on this limited data and approach, furthermore, are low and approximately an order of magnitude lower than values from other regions and watersheds. For example, a memorandum published by EPA in 2010 provides a good summary of background levels for dioxins/furans in sediment, which range from approximately 2–5 parts per trillion (ppt) as TEQs. It also summarizes values from Puget Sound which include a TEQ value of 4 ppt for non-urban areas but allowing up to 10 ppt as TEQs for open water disposal; this value is also used in San Francisco Bay and elsewhere. (https://klamathrestoration.gov/sites/klamathrestoration.gov/files/EPA%20Klamath%20dioxin%20memo%201-13-10%20final.pdf). The Duwamish Waterway FS establishes an upper bound background value for dioxins/furans as 11.6 ppt TEQ.

Background values in other regions and watersheds are expressed as TEQs, which is generally the manner in which cleanup goals for dioxins/furans are expressed. For Portland Harbor, EPA used 5 individual congeners. The individual congener background values provided in Appendix B of the FS and in the PRG tables for RAOs 2 and 6 can be converted to TEQs using TEFs, which results in a value of 0.56 ppt on a TEQ basis (since the 5 congeners equate to the majority of the risk, this value may be slightly biased low, but probably less than 10% of the total TEQ). This background value is an order of magnitude or more lower than the range of values, mainly for non-urban areas, from the literature. A study to better define background levels for dioxins/furans is necessary since the calculated risk-based PRGs are well below even these low-biased background levels resulting in the background values being adopted as the final PRGs. Otherwise, it is unlikely that the remedies for dioxins/furans will be successfully implemented and estimated risk reductions for dioxins/furans will be realized. This latter issue addresses the validity of the alternatives analysis and its biased outcome.

It should also be noted that no background values are listed for RAOs 1 or 3. Those PRGs are expressed as TEQs and data is lacking to identify a background level on a TEQ basis. This needs to be rectified; those PRGs may be below background. In fact, the PRG for RAO3 is 4 orders of magnitude below the MCL and is likely not measurable at that level. Overall, providing PRGs that are below MCLs is inconsistent with other cleanup actions under CERCLA or other programs. Cleanup to below MCLs is unlikely to be achievable.

11b. Background concentrations for other COCs and media

The FS (Section 2.2.2.4) states that only sediment background concentrations were estimated and background concentrations for other media could not be calculated due to insufficient data. However surface water background concentrations were calculated in the RI. Upriver surface water background concentrations COCs are orders of magnitude higher than the ARARs based on the AWQC. Note, the background UCLs for upriver surface water (dissolved concentrations with outliers removed; Table 7-4b of RI) vs RAO3 AWQC-based PRGs. For example, the background UCL concentrations for DDT, PCBs and TCDD Teq are all significantly less than the respective RAOs for these substances:

- background UCL for DDT = 0.000114 µg/L and the ARAR (RAO3) is 0.00002 µg/L
- background UCL for PCBs = 0.000126 µg/L and the ARAR (RAO3) is 0.000006 µg/L
- background UCL for TCDD Teq = 0.000126 µg/L and the ARAR (RAO3) is 0.000000033 µg/L

Because of the deficiencies in determining the background levels, a new background study for sediment, surface water and tissue needs to be conducted in the design phase. The results of this evaluation need to be used to update PRGs, RALs and SDUs.

EPA should not use background to establish cleanup goals when likely ongoing contaminant inputs from upland sources within the Site and upriver of the Site exceed EPA's calculation of background. A better approach was provided by the LWG using equilibrium values.

12. Benthic risk models do not honor the measured data

EPA made extensive changes to the benthic approach for this FS, but those changes are still inconsistent with the comprehensive benthic risk approach contained in the approved BERA). The FS states: "The protection of benthic species to contaminated sediment is evaluated using the benthic risk area defined by an order of magnitude greater than the RAO5 PRGs. The post-construction interim target for RAO5 was established at 50% reduction in the area posing unacceptable benthic risk." So, instead of using the CBRA, EPA now maps benthic PRG exceedance factors on a point-by-point basis and uses a 10 times exceedance factor to identify areas of concern. EPA then concludes that if 50% of this area is actively remediated, the alternative is "protective" on an interim basis. It is completely unclear how this new method is: 1) in any way more accurate or consistent with the BERA; and 2) more predictive of benthic risk or the effectiveness of the alternatives, as compared to simply using the CBRAs, which are entirely consistent with the BERA.

Furthermore, and most importantly, the benthic risk models used by EPA do not honor the measured data. Although the LRM and FPM are model predictions using data from the toxicity texts conducted with site sediments, much of the measured data is not honored. Any modeled risk for benthic invertebrates that ignores actually toxicity testing results needs to be assessed in weight-of-evidence and river-mile specific decision-making. The benthic risk footprints should not extend into areas shown to have a lack of toxicity based on actual laboratory toxicity tests. This error has been carried through the alternatives analysis and therefore has biased the selection of alternatives for SMAs in the FS.

EPA should modify the benthic approach in the FS so it is consistent with the BERA and honors all measured data.

13. Food Web Model (FWM) for DDx and PCDD/Fs

The FWM is used by EPA to back-calculate concentrations of chemicals of concern (COCs) in sediment associated with acceptable, risk-based human health and ecological concentrations in fish tissue as calculated using the baseline risk assessment (Kennedy/Jenks, 2013). This influences sediment PRGs and hence RAOs, so uncertainty originating with the FWM cascades, having compounding effects on the evaluation of remedy alternatives, and could result in additional remediation costs with no meaningful gains in risk reduction. We identify the following shortcomings with EPA's application of the FWM at the Site:

- A comprehensive and detailed Conceptual Site Model (CSM) for the Site in total, and for the relationship between COC sediment and fish tissue concentrations specifically, has not been presented by EPA. This means that EPA's chief assumptions for the FWM related to steady-state conditions (in a major river), the completeness of the site characterization dataset, regional contributions of COCs, and the apparent relationship between sediment and fish concentrations cannot be collectively operationalized in terms of their overall magnitude and accuracy.
- Based on an examination of the empirical data for the Site, no statistically significant relationship is observed between sediment and fish tissue concentrations for DDx and PCDD/Fs at the concentrations relevant to risk decision making. This means that the FWM - which assumes such a relationship exists – is not reliable and that the conclusions reached on its basis are fundamentally inaccurate .
- Good modelling practice was not used by EPA for the FWM, and in particular sufficient model documentation detailing the work does not exist. Adequate model documentation is one of several criteria used by EPA and other international regulators for determining the acceptability of a model for regulatory decision making (USEPA 2009, EFSA, 2014, Grimm et al., 2014).

EPA should not use their FWM to evaluate sediment PRGs if there is no statistical relationship between sediment and fish tissue concentrations for key COCs such as DDx and PCDD/Fs.

14. Overly prescriptive and flawed approach used to assign remedial technologies

The FS acknowledges uncertainties in site characterization and the conservative assumptions used to form the basis for associated technology assignments, however EPA continues to use a prescriptive set of technology evaluation and scoring criteria to determine the technologies to be applied in each area of the site and, with the exception of a vague paragraph in Section 3.8.1, the FS is silent regarding the degree of flexibility that is envisioned to be available during remedial design to refine technology assignments based on the additional information gained through future pre-design investigations. This will lead to a lack of flexibility with regard to technology assignments, depth of removal, potential improvements in technology, design efficiencies to address remedial and CWA/ESA requirements, etc.

EPA should clearly explain the conditions under which changes to major alternative elements (e.g., changes in technologies assignments, methods to address PTW, methods for determining treatment and disposal requirements, requirements for rigid containment) might be considered or allowed. EPA should explain how new data, including the "initial conditions" assessment will affect the selection of alternatives and the RAL boundaries based on current surface sediment concentrations. The FS should include language to allow for updates to risk assessments. EPA should incorporate decision frameworks for proposing equally or more effective capping options or other technology refinements based on detailed design-level evaluations and new data.

Specific examples of EPA's flawed approach for assignment of remedial technologies:

- EPA makes unsupported assumptions regarding nature and extent of contaminated groundwater discharge which drive inappropriate, prescriptive technology assignment decisions that fail to provide flexibility to develop appropriate site-specific designs and mandate use of potentially unnecessary materials (e.g. reactive amendments and/or cap armor).

- The FS fails to provide evidence supporting speculative assertions of groundwater impacts, and selectively ignores facts including the physical effects of upland controls on contaminant transport/mobility (i.e., significant reduction in advection) which would otherwise allow for remedial design that considers, and is compatible with, upland SCMs. Similar to EPA's treatment of riverbank areas (Item 18 below) arbitrary assumptions regarding nature/extent of contaminated groundwater are carried forward into the evaluation of alternatives and given weight for assessing the relative effectiveness of alternatives with respect to RAOs 4 and 8, which biases the outcome of alternative selection.
- While EPA's decision trees prescribe specific technologies amenable for use under heavy structures, it fails to consider the need for flexibility during design to adapt to any number of other site-specific constraints including slope stability, proximity to nearshore structures, etc. and preclude use of other technologies of potentially equivalent effectiveness.

EPA should modify the FS to clearly explain the conditions under which changes to major alternative elements might be considered, explain how new data will affect the selection of alternatives and the RAL boundaries based on current surface sediment concentrations, include language to allow for updates to risk assessments, and incorporate decision frameworks for proposing equally or more effective capping options based on detailed design-level evaluations and new data.

15. Prescriptive dredge residuals management strategy

The prescribed application of 12-inches of sand across the entire dredge footprint (amended with AquaGate+PAC[2] in areas where PTW present) is very poorly supported. The FS is misleading in stating that the placement of sand (and GAC in areas where EPA has speculated that PTW is present) immediately following dredging will eliminate the need for additional dredge passes. The FS indicates that sediment cores would be taken post-placement to verify thin-layer residual cover successfully reduces residuals concentrations. It is inappropriate to assume a 12-inch layer of residuals management cover will be applied across the entire dredge footprint, without providing a strategy that will determined the necessity for thin-layer placement and flexibility to develop an appropriate thickness.

As PAC can be toxic to benthic organisms, overall quantities, where and how it is applied warrants more thoughtful consideration. The FS neglects to consider the physical stability of PAC in the deployment of the thin-layer residuals cover. PAC will be ineffective if it immediately washes away. The FS neglects to consider any possible unintended consequences that may be posed by transport/erosion and aggregation of PAC (with, or without adsorbed contamination) in depositional areas. The assumed performance requirements for this residuals strategy are unclear.

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[2] The text makes numerous inappropriate references to specific commercial products (i.e., AquaGate+PAC, Aquablok) as components of the conceptual remedial design. The FS should provide flexibility to consider other commercially products for a given class of technologies.

The prescriptive dredge residual strategy should be removed from the FS. If left in, the strategy and rationale for the residual management approach should be clearly explained, and a flexible, objective approach to assessing the need for and approach residual management should be allowed.

16. Inappropriate use of rigid containment technologies

EPA assumes the use of sheet pile barrier walls as dredge water quality control measures based on the suspected presence of NAPL will support the short term effectiveness of all alternatives. The FS still fails to adequately evaluate the implementability, effectiveness and cost of this particular technology relative to other technologies and BMPs.

In making gross assumptions for this FS, EPA has disregarded the complexity of constructing such barrier walls (e.g. consideration of structural components such as king piles and structural bracing, or more complex cofferdam structures) and the associated impacts this will have on numerous aspects of remedy implementation ranging from construction duration (e.g. time required to install walls, and impacts to dredge production rates) to the overall net benefit and cost effectiveness relative to other means. EPA also continues to show figures that depict sheet piling in greater than 50 feet of actual water depth, which is technically infeasible. These figures also imply that sheet piles will be installed in the navigation channel, which would infeasibly obstruct vessel traffic. Sheet pile would also impact ongoing water dependent operations and nearshore fish migration does not evaluate whether sheet piles in the navigation channel could be permitted by USACE.

Because of the technical infeasibility of the use of sheet pile barrier walls, their consideration as a feasible technology for dredge water quality control measure should be removed from the FS.

17. Flawed evaluation used to determine whether PTW can be reliably contained

Notwithstanding Arkema's objection to EPA's definition of PTW, and assertion it is present offshore of the Arkema site, the approach used to determine applicable remedial technologies to address PTW in the draft final FS is flawed because it is based on a simplistic, overly conservative screening analysis and does not include standard engineering methods used to assess and ensure reliability. Additionally, EPA neglects to consider the current state of practice for reactive capping.

According to EPA, PTW is a concept used in the NCP to characterize contaminant source material (USEPA 1991). PTWs are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. In the 1991 guidance, EPA stated their expectation that PTW would be treated, wherever practical, because of current technical limitations of long-term reliability of containment technologies. The long-term reliability of containment of certain NAPL PTWs has improved through the development and implementation of reactive capping, as demonstrated by EPA (USEPA 2013). The draft final FS does consider and propose reactive capping but uses a flawed, simplistic screening analysis to limit its use through designating certain SMAs as PTW NAPL/NRC, reflecting those areas where purported NAPL is deemed not reliably contained (NRC). Furthermore, the draft final FS is not consistent with the EPA guidance on principal threat and low-level threat wastes (LTW) (USEPA 1991), as it does not differentiate PTW from LTW NAPL based on toxicity, mobility, and (realistic) reliability of containment, but uses NAPL and PTW interchangeably. For instance, for shallow areas it states that NAPL or PTW that is not reliably contained within an SMA would be dredged to the lesser of the RAL concentrations or 15 feet.

To determine the boundary for where PTW can be reliably contained, two limited capping options were modeled in Appendix D to determine the maximum concentrations of PTW material that would not result in exceedances of AWQC in the sediment cap pore water after a period of 100 years. Contaminants modeled were chlorobenzene, dioxins/furans, DDx, naphthalene, PAHs, and PCBs. Appendix D contains the following errors or ommissions:

- The objectives of the analysis are not clearly identified. The document states "this appendix is evaluating whether or not PTW at the Site can be reliably contained under specific assumptions". However, at the end maximum containable sediment concentrations of 320 µg/kg and 140,000 µg/kg for chlorobenzene and naphthalene are presented;
- The two potential active cap designs modeled (thickness of capping layers and amount of active material in cap for a reasonably conservative approach and a more aggressive augmented capping approach) are not representative of the current state of practice for reactive capping and so cannot be used to determine the contaminant concentrations that cannot be reliably contained;
    - The reasonably conservative approach (12-inch active layer containing 5% activated carbon by weight) is not applicable for NAPL sites. The example site referenced (Berry's Creek in New Jersey and Bailey Creek, Fort Eustis in Virginia) are likewise not NAPL sites. Additionally, Berry's Creek represents a very small pilot-scale test of reactive cap technologies.
    - The more aggressive augmented capping approach (12-inch active layer containing 20% activated carbon by weight) is also not applicable for NAPL sites. Organoclay is a more applicable and effective amendment for NAPL site (McCormick Baxter and West Branch Grand Calumet River).
    - GAC may have a greater absorption capacity than organoclay on an equivalent weight basis with regards to some dissolved phase contaminants, but it can easily be fouled by NAPL.
- The long term reliability of a reactive cap is a direct function of the thickness of the reactive layer and the amendment(s). A more reliable reactive cap with a thickness greater than 12-inches and consisting of a lower layer of organoclay and an upper layer of GAC should have been considered in Appendix D.
- Maximum porewater concentration of chlorobenzene used as a continuous source term in the model is based on the relatively old Remedial Investigation (RI) database and is not representative of current conditions, let alone for the next 100 years. In addition, EPA has used data that was not collected pursuant to the RI. EPA has used reconnaissance data collected using a Geoprobe rig. The data are unacceptable for and cannot be used to represent porewater chlorobenzene concentrations. Therefore, the maximum porewater concentration EPA used is based on inappropriate data and needs to be replaced in the model. Since the RI data collection, a barrier wall and pump and treat system has been installed along the shoreline of the Arkema site. It is anticipated that any remaining dissolved-phase chlorobenzene left beneath sediments (stranded wedge along toe of riverbank) will continue to naturally attenuate. Furthermore, maximum data are not

appropriate for assessing engineering performance, including reliability. A more appropriate input parameter is the 90th percentile concentration.

- A range of seepage velocities were evaluated (0.3, 3, and 30 cm/day), representing the minimum, average, and maximum values measured at the Site. However, actual seepage velocities in SMA 7W are likely lower than 0.3 cm/day due to presence of barrier wall and pump/treat system.

EPA should revise the active cap modeling calculations to be transparent and clearly explain the assumpions in the model, model the active cap layers using current state of practice assumptions, utilize realistic long-term source concentrations in the cap model, and use a range of seepage velocities.

18. Riverbank contaminants adjacent to the Arkema Site

PCBs are listed as a riverbank contaminant at Arkema, but have only been detected in small number of samples below the applicable screening levels (with one exception, one sample slightly exceeded a conservative bioaccumulative SLV). The FS references an attached riverbank database, but the database was not included. Consequently, LSS continues to have no way to verify any of EPA's FS decisions regarding remediation of the river banks. Regardless, prior issues with EPA's source control approach remain. Two key issues are (1) risk-based PRGs should not be established based on exposure pathways being evaluated as part of the upland source control evaluations under DEQ and (2) that none of these upland media were evaluated in the BLRAs or RI. EPA's use of sediment PRGs for riverbanks, which were even applied to areas rarely submerged by the river and without considering fate and transport (e.g., attenuation), is technically unsupportable and inappropriate. Delineations of groundwater plumes and riverbanks, and a zero post-construction restoration time frame are arbitrary. There is a total lack of data and analysis as to what risk considerations are driving the specific remedial actions delineated (and therefore how such analyses will be refined in the design phase when further data/analysis is available) and what specific remedial actions will be implemented in which areas driven by those risks. This arbitrary delineation is then carried forward into the evaluation of alternatives and used to assess the relative effectiveness of alternatives. This appears to significantly bias the outcome of alternative selection.

Source control measures taken at the Arkema Site have largely eliminated the stormwater pathway from this site. Groundwater controls, namely the installation of a slurry wall and a groundwater extraction and treatment system designed to prevent migration from the uplands to the river, have eliminated the groundwater pathway.

The June 2016 FS fails to include a discussion of upland source controls that have been implemented as well as failing to include anything related to the performance of source controls in the remedial evaluations.

The FS report should be modified to include appropropriate risk-based PRGs developed for riverbanks rather than sediments and should acknowledge and include a discussion of upland source control measures in the remedial evaluations.

19. Updates to risk assessments

The FS should include language for allow for changes in pre-design work, to allow for updates to risk assessments. For example, if sediment and/or fish tissue samples are collected which show concentrations less than target levels, then PRGs/RALs would need to be revisited. Similarly, if additional studies on benthic toxicity are conducted for a portion of the river, those results should be used to update the remedial footprint for RAO5. Several source control actions have been undertaken and completed since the RI dataset was collected. Thus, areas of the river, COCs and media previously shown to show unacceptable risk may no longer show risk. Thus, a remedy may not be necessary to address some or all RAOs where such changes have occurred. Furthermore, as noted above, background levels are not well defined based on the RI dataset and need to be updated and re-assessed to develop more robust background values. Because many of the COCs have PRGs based on or very close to background levels, as currently defined, an improved understanding background conditions is key to a successful remedy. Otherwise, predicted risk reductions, which are already minimal, will not be realized. The potential outcome is a high cost remedy which provides no public benefit.

Section 2.2 of the FS only states: "Achieving the above RAOs relies on remedial alternatives' ability to meet final remediation goals/cleanup levels derived from PRGs. At this point, Table 2.2-1a-d provides PRGs that are based on such factors as risk, ARARs, and background. Section 2.2 of the FS also states "PRGs may be further modified through the evaluation of alternatives and the remedy selection process. Final cleanup levels will be selected in the Record of Decision." Yet, there is no other mention of the process in the FS.

EPA should modify the FS to clearly describe data gaps and uncertainties that can be addressed during design, including listing anticipated pre-design and design studies, developing robust background values and using any new measured data, and the process for modifying PRGs and remedies based on these studies.

20. Evaluation of MNR

The Monitored Natural Recovery (MNR) evaluation is insufficient to support the alternatives evaluation. The FS continues to omit key components of an MNR evaluation as required by guidance (such as EPA's 2005 sediment remediation guidance) including: 1) an adequate CSM; 2) appropriate evaluation of multiple lines of empirical evidence; and 3) a quantitative evaluation of natural recovery and the associated long-term (i.e., after "time zero") outcomes of the alternatives. New concerns with this FS include:

- EPA added new information on bathymetry changes and fish tissue. In Section 3.6.1.3, EPA's updated evaluation of fish tissue concentrations over time completely ignores 2012 data without any explanation.
- EPA states that, "Therefore, a minimum deposition rate of 2.5 cm/year was assumed as the criteria [sic] for effective MNR." This criterion is obviously not used by EPA in the FS because the FS assumes MNR as the applicable technology for all areas outside SMAs (as opposed to applying MNR in just areas exceeding the minimum deposition rate). Although we agree with the wide application of MNR, EPA's explanation of its MNR evaluation process is full of inconsistencies and errors.
- Rather than assuming an effective conceptual framework that will incorporate new information and adjust the assignment of MNR to specific areas during design, the FS

focuses on minor challenges affecting one, of multiple, lines of evidence used to assess natural recovery rates (i.e. EPA emphasizes the challenge in assessing deposition rates for the shallow region using bathymetric data - given an assumed inability for survey boats to maneuver and obtain quality data.) In its biased presentation of this matter, EPA ignores multiple lines of evidence that can, and should, be used to reduce uncertainties during design and be used to refine technology assignments.

As stated in prior comments, the FS should be revised to incorporate a technically sound CSM, and quantitative evaluation of natural recovery and associated long-term outcomes, drawing on all available empirical lines of evidence. At a minimum, the FS should be revised to provide sufficient flexibility to address the deficiencies noted with EPA's evaluation of MNR and provide framework for making adjustments/refinements to assignment of MNR areas during remedial design based on collection of new information.

As noted above, the 14-day review time for the dispute is too short to capture all of the potential issues with and FS report that is several thousand pages long and lacks transparency. Additional issues regarding EPA's FS will be provided prior to the end of the 60-day comment period for the Proposed Plan. Please contact me at (610) 594-4430 if you have any questions pertaining to this letter. Thank you.

Sincerely,

Legacy Site Services LLC

J. Todd Slater
Assistant Vice President

cc: (electronic)

Lori Cora, U.S. Environmental Protection Agency, Region 10
Sean Sheldrake, U.S. Environmental Protection Agency, Region 10
Jim Woolford, U.S. Environmental Protection Agency, EPA Headquarters
Mathy Stanislaus, U.S. Environmental Protection Agency, EPA Headquarters
Stan Meiburg, U.S. Environmental Protection Agency, EPA Headquarters
Confederated Tribes and Bands of the Yakama Nation
Confederated Tribes of the Grand Ronde Community of Oregon
Confederated Tribes of Siletz Indians of Oregon
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Warm Springs Reservation of Oregon
Nez Perce Tribe
Oregon Department of Fish & Wildlife
United States Fish & Wildlife
Oregon Department of Environmental Quality
LWG Legal
LWG Repository

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EXHIBITS

Exhibit 1. LSS Plots of PCB SWACs

Exhibit 2. Arkema Offshore NAPL Evaluation (CDM Smith 2013)

Exhibit 3. Final Draft Pre-Remedial Design Investigation Work Plan (Integral 2016)

Exhibit 4. EPA FOIA Document

Exhibit 5. Arkema PTW Map (Figure 3.2-4 from USEPA and CDM Smith 2016)

Exhibit 6. Sediment Waste Disposal Maps (Figures 3.4-35 and 3.4-36 from USEPA and CDM Smith 2016)

Exhibit 7. PCB RAL Contours (Figure 3.4-7 from USEPA and CDM Smith 2016)

Exhibit 8. 2,3,4,7,8-PeCDF RAL Contours (Figure 3.4-11 from USEPA and CDM Smith 2016)